

Section 2 ■ CONTENTS

FOREWORD	1
INTRODUCTION	1
DEMOGRAPHICS AND ECONOMIC FUTURE	2
WATER SUPPLY AND USE	2
MANAGEMENT	2
REGULATION/INSTITUTIONAL CONSIDERATIONS	3
STATE AND FEDERAL WATER RESOURCES FUNDING PROGRAMS	3
WATER PLANNING AND DEVELOPMENT	3
AGRICULTURAL WATER CONSERVATION AND DEVELOPMENT	5
DRINKING WATER SUPPLIES	5
WATER POLLUTION CONTROL	5
DISASTER AND EMERGENCY RESPONSE	6
FISHERIES AND WATER-RELATED WILDLIFE	7
RECREATIONAL ASPECTS OF WATER DEVELOPMENT	7
FEDERAL WATER PLANNING AND DEVELOPMENT	8
WATER CONSERVATION	8
INDUSTRIAL WATER USE	9
GROUNDWATER	9

Section 2

EXECUTIVE SUMMARY

The Bear River Basin Plan is presented in 19 sections. This executive summary is a synopsis or abstract of the other 18 sections which cover aspects of water resources in Utah's portion of the Bear River Basin. The following headings are titles of each of the sections summarized. The reader should study individual sections for more information.

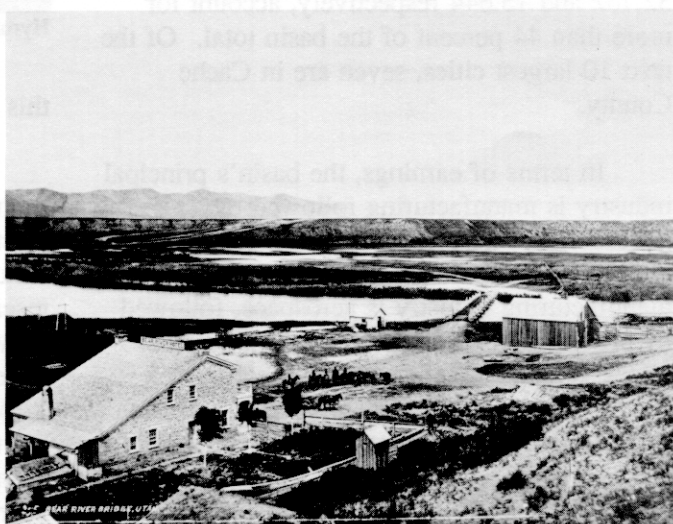
FOREWORD

The **State Water Plan**, published in January 1990, provided the foundation and overall direction to establish and implement state water policies and recommendations. As part of the state water planning process, more detailed plans are prepared for each of the eleven hydrologic basins in the state. The Bear River Basin is the first of these. One goal of the river basin plan is to help strengthen the planning efforts at the local level. The plan is consistent with actions of the Bear River Development Task Force and intent of Utah's Bear River development legislation.

INTRODUCTION

Section 3 provides a general physical description of the Bear River Basin. The entire Bear River Basin covers 7,583 square miles, including portions of Wyoming, Idaho, and Utah. Of this total, 3,381 square miles are in Utah, including all of Rich and Cache counties and parts of Summit and Box Elder

counties. The total river length is about 500 miles, beginning in the Uinta Mountains at elevations near 13,000 feet, and ending in the Great Salt Lake at an elevation of about 4,200 feet. Aspen and conifer forests cover about 27 percent of the basin; juniper,



Hampton Ford Station on the Bear River, 1872 - USGS

sagebrush, and other brush cover 37 percent; cropland about 20 percent; and the remaining 16 percent includes marshland, open water, residential, and other categories. Climate varies from 40 inches precipitation with harsh winters at higher elevations to nine inches and moderate temperatures at lower elevations.

This section also includes general planning guidelines and organizational arrangements used in preparing the basin plan. The basin planning process provides opportunity for public involvement by state and federal agencies, as well as local governmental entities, organizations, and individuals.

DEMOGRAPHICS AND ECONOMIC FUTURE

Population and economic aspects are discussed in Section 4. The 1990 census count of basin population within Utah was 108,393, including 70,183 in Cache County, 36,485 in Box Elder County, and 1,725 in Rich County. Logan and Brigham City, with populations of 32,762 and 15,644 respectively, account for more than 44 percent of the basin total. Of the next 10 largest cities, seven are in Cache County.

In terms of earnings, the basin's principal industry is manufacturing followed by government, retail trade, services, construction, and farming. The most important manufacturing industry is aerospace, followed by processing of agricultural products. The largest single employers are Thiokol in Box Elder County with 8,150 employees, and Utah State University in Cache County with 4,500.

The Bear River Basin population is projected to increase to 162,400 by the year 2020, including 107,200 in Cache County, 52,200 in Box Elder County, and 3,000 in Rich County. Employment in construction and manufacturing is expected to increase about 67 percent each by the year 2010.

WATER SUPPLY AND USE

Section 5 discusses historical flows, developable water supplies, present water uses, and interbasin water supply planning. About 1.5 million acre-feet of water has been developed for various uses in the Utah portion of the Bear River Basin. About 60 percent of



Hyrum Reservoir - Div. of Water Resources

this total is used for irrigation.

Development of additional water is limited by the Amended Bear River Compact, existing Utah water rights, wide variations in annual runoff, and scarcity of favorable new reservoir storage sites. The average annual flow for the 1941-1990 period at the Bear River's lowest gaging station near Corinne is 1.232 million acre-feet. However, the practical limit for new depletions of water in Utah is estimated to be about 196,000 acre-feet per year. Annual estimated imports to the Bear River Basin near Brigham City, Utah, are 11,600 acre-feet. Annual estimated exports near Alexander, Idaho, are 23,000 acre-feet.

MANAGEMENT

In general, the water in the Bear River Basin is well-managed. Section 6 describes the existing water management systems in the basin for irrigation, municipal, industrial, and waterfowl uses and gives a brief discussion on the cloud seeding program. The Bear River is managed by court decrees, the Bear River Compact, and contracts with Utah Power &

Light Company. The UP&L operates Bear Lake for downstream irrigation and hydropower uses. Over 200 irrigation companies divert and use water in Utah. The 52 community water systems in the Utah portion of the basin provide culinary water to essentially all of the residents. Bear River water is managed for waterfowl use at the federal Bear River Migratory Bird Refuge, two state-owned waterfowl areas, and at nine privately-owned duck clubs.

REGULATION/INSTITUTIONAL CONSIDERATIONS

Section 7 discusses existing water rights, the Bear River Compact, the jurisdiction of land areas, and related problems. Any water development on the Bear River must conform to established water rights and the Amended Bear River Compact. The State Engineer is currently adjudicating water in the Bear River Basin.

The Bear River Compact was approved in 1958 and amended in 1980. An interagency, interstate commission was created to administer provisions of the compact. The 1980 amended compact provides for the protection of all prior rights applied to beneficial use as of January 1, 1976, and the protection of all rights granted under the 1958 compact. The 1980 amended compact also includes groundwater development in allocations, additional storage rights to all three states above Bear Lake, and allocation of the remaining water below Bear Lake between Utah and Idaho.

STATE AND FEDERAL WATER RESOURCES FUNDING PROGRAMS

Funding programs available for planning and development of water resources in the Bear River Basin, and a brief review of cost-sharing considerations, are discussed in Section 8. Most programs are available statewide. However, the Bear River Development Account established by the 1991

Utah Legislature is available only for basin water development and specifies the basis for cost-sharing. Over the last 40 years, at least \$70 million in financial assistance has been provided by state and federal agencies for a wide variety of water activities and facilities in the Bear River Basin. Most communities in the basin have benefitted from these expenditures.

WATER PLANNING AND DEVELOPMENT

Section 9 describes potential water development alternatives for the Bear River Basin. Various considerations related to water development are discussed such as present water uses and supplies, future water needs, options for meeting needs, potential reservoir storage sites, environmental impacts, water quality assessment, costs, and economic and financial analysis. A suggested water development plan and implementation schedule are presented, and recommendations are included for additional activities needed to finalize and implement the plan.

The currently developed water supplies in the basin are slightly greater than the uses. While the Bear River Basin, as a whole, has sufficient public community water supplies to meet municipal and industrial (M&I) demands for the next 20 years, some individual systems are rapidly approaching their limits and will need new sources of water in the near future. Alternatives examined to meet future demands in and out of the basin include building reservoirs, increasing groundwater use, accelerating conservation/education, and transferring water rights.

Building storage reservoirs is considered the most practical alternative to develop large quantities of new Bear River water. In the lower Bear River, the Division of Water Resources has evaluated almost 40 potential reservoir sites. Sites included as potential

projects in the Bear River Development Act are the Avon, Barrens, Honeyville, Hyrum Enlargement, Mill Creek, and Oneida Narrows. Environmental analyses and water quality assessments were conducted on all of these sites except the Oneida Narrows. Computer models were used to estimate yields from each individual reservoir as well as various combinations of reservoirs on the Bear River system in conjunction with the Willard Bay Reservoir.



Honeyville Site - Div. of Water Resources

An economic analysis was performed for these various projects to determine if the benefits will exceed the cost. Benefits were analyzed without regard to whom they accrue and costs were calculated without regard to who pays the cost. Four project alternatives are presented where benefits exceed costs.

On the basis of investigations, evaluations, and assumptions previously discussed, the division suggests the following water development plan: 1) enlarge Hyrum Reservoir, 2) connect the Bear River with a pipeline/canal to Willard Bay Reservoir, 3) provide

conveyance and treatment facilities to deliver water to the Wasatch Front, and 4) build Honeyville Reservoir. The plan should be implemented in the order listed and will take an estimated 30-35 years to complete. Construction on any project cannot begin until all technical investigations are completed, contracts have been made for sale or lease of at least 70 percent of the water, permits have been obtained, an environmental mitigation plan has been prepared, and funds have been appropriated by the Legislature. If future needs do not develop as anticipated, the plan will be modified.

A financial analysis was performed on the suggested plan to separate costs of the project into categories and decide who should pay them. The Bear River Water Development Act stipulates that the state will own and finance construction of dams. Purveyors will finance and build distribution systems to convey water to their customers. Total project costs are estimated at about \$270 million. Annual revenue to the state is nearly \$8 million. Non-reimbursable costs are about \$9 million.

Recommendations concerning future water planning and development are:

- obtain water sales agreements,
- continue a dialogue with Idaho on a joint Oneida Narrows Project,
- do detailed investigations of enlarging Hyrum Reservoir,
- investigate diversion of water from Blacksmith Fork to the Hyrum Reservoir,
- determine the interest of the U. S. Fish and Wildlife Service in a joint water development project.
- identify the most effective conveyance alternative for delivering Bear River water to Willard Reservoir,
- study alternatives for delivering water from the Hyrum Reservoir to Box Elder County and;
- protect the Honeyville and Hyrum Reservoir sites for future reservoir use.

AGRICULTURAL WATER CONSERVATION AND DEVELOPMENT

Section 10 describes the agricultural industry in the Bear River Basin, and discusses problems and potential solutions. Within the Utah portion of the basin, about 420,000 acres of land are cultivated, of which 301,700 acres are irrigated. The total consumptive use on the irrigated cropland, including rainfall, is estimated to be 535,600 acre-feet. The Bear River Canal Company operates the largest irrigation water delivery system in the basin, serving about 64,000 acres. The 12 largest irrigation companies deliver water to 48 percent of the irrigated land in the Utah portion of the basin.

The long-term trend in irrigated land in the Bear River Basin is nearly constant. This basin is one of the few places in the state where water and land are available for expansion. New irrigation projects, such as the South Cache and Bonneville Bench projects, are currently economically infeasible. Small, isolated acreage within areas served by existing irrigation systems could be irrigated if water was available. Also, an estimated 39,000 acres of existing irrigated cropland with occasional late season water shortage could use supplemental water.

In planning and evaluating future multipurpose water development projects in the Bear River Basin, consideration should be given to providing irrigation water for new lands and supplemental irrigation water for existing lands wherever water users are financially willing and able to participate.

DRINKING WATER SUPPLIES

Section 11 describes the present drinking water systems in the basin, discusses present and future problems, and presents estimated future water requirements. In the Utah portion of the Bear River Basin, 128 drinking water systems have been identified. Fifty-two of

these systems are classified as "public, community" which serve at least 15 residences occupied year-round; 42 are "public, non-community" which serve at least 25 non-residents for 60 days or more; and 34 are "non-public" which do not meet the other criteria. Most public community water systems are owned and operated by a municipality, but a few are owned and operated by a private company or a state or federal agency.

Of the 52 public community water systems, nine are not approved by the Utah Division of Drinking Water, 10 systems are currently deficient in source capacity, and 9 systems are currently deficient in storage. These drinking water systems provided an estimated 51,170 acre-feet of water for residential and commercial use in 1990. The corresponding future requirement is estimated to reach 65,560 acre-feet per year by the year 2010.

A review of five state/federal funding programs shows that at least \$30 million has been spent in 41 communities since 1970 to improve drinking water systems. The costs to install new facilities and improve existing facilities and anticipated costs to meet new federal requirements will be enormous. Continued state financial assistance will be needed.

WATER POLLUTION CONTROL

Data and information on existing levels of water pollution throughout the basin are presented in Section 12. Sources of pollution are identified, problems and solutions are discussed, and recommendations for control and improvement are given. An assessment and planning project is currently underway to better define problem areas, develop solutions, and implement a water quality management framework to protect and enhance the quality of the basin's surface and groundwater resources.

Most groundwater in the Bear River Basin is good quality. The quality of surface water, however, varies widely. The quality of surface water that enters Utah from Wyoming is considered to be good, but the quality deteriorates as the river flows downstream through the three states. In general, each tributary stream shows a similar pattern of downstream deterioration.

Of the 35 Utah communities below the Utah-Idaho state line, 15 have municipal wastewater treatment facilities. Several additional communities are contemplating constructing new sewage collection and treatment systems. The basin has 10 municipal and eight industrial permitted wastewater treatment facilities. In addition, a number of facilities do not discharge and are not required to obtain a permit. Other communities have recently received state and federal funds for planning, design, or construction of centralized wastewater collection and disposal systems. The estimated capital cost expenditure to meet current wastewater needs in the Bear River Basin is \$346.5 million.



Bear River Flooding

Non-point source (NPS) pollution is a major contributor to water quality problems in the basin. Of the 21 Utah watersheds prioritized for water quality improvement under the NPS program, three are in the Bear River Basin, and all are in Cache County. Of the many agricultural impacts on water quality, animal waste from dairies and feedlots deserves special attention. The Little Bear River system is currently serving as a demonstration area for a river management pilot project to control water pollution. The project will determine the feasibility of implementing corrective measures and annual maintenance and preventive programs.

DISASTER AND EMERGENCY RESPONSE

Section 13 defines the organizational responsibilities for emergency response in the Bear River Basin, concentrating mainly floods and drought, the two most common water-related emergencies. Other emergency situations are also briefly considered.

Flooding is common in the basin, but because damages have been moderate, it has not been a major local problem. Most of the damages from floods are from erosion and sediment deposition. Primarily, agricultural land and property have been damaged. Most of the Bear River flood plain has a high water table, and construction of homes and other buildings within this zone has been limited. The most notable flood occurred when The Great Salt Lake reached a record high level in 1986. The lake inundated the Bear River Migratory Bird Refuge and other private and public facilities along its shoreline, and caused millions of dollars in damages. Droughts have occurred fairly frequently in the Bear River Basin. Because they are usually basinwide or statewide in nature, they have been dealt with in the past on a statewide basis. A drought response plan is in place to provide an effective means for the state to assess and respond to drought impacts. The immediate

and primary responsibility for drought relief rests with local authorities of city and county governments. State action is taken only when local capabilities cannot cope with the needs. To prepare in advance for the difficult problems associated with droughts, each county and community should formulate its own drought response plan.

FISHERIES AND WATER-RELATED WILDLIFE

Fish and wildlife resources in the Bear River Basin are described in Section 14 along with a discussion of existing needs, alternatives solutions, and recommendations. The basin provides unusually good habitat for a wide variety of fish and wildlife. The Bear River Migratory Bird Refuge has national significance, and the state operates several waterfowl and wildlife management areas. Much of Utah's Class I trout fisheries, significant reaches of Class II streams, and a unique fishery in Bear Lake are within the basin.

Water quality problems in Hyrum, Newton, Cutler, and Mantua reservoirs, and the Bear River and Little Bear River in Cache Valley are of special concern to fish and wildlife. Several different efforts and programs are aimed at improving water quality in these areas, including the non-point source pollution program on the Little Bear River, watershed improvement plans, public information and education, and the water quality management plan.

When the Great Salt Lake rose to its record level in 1986, it inundated the Bear River Migratory Bird Refuge and caused extensive damage to facilities. As a part of a major restoration program, the Fish and Wildlife Service prepared an environmental assessment in 1991 which considered four alternatives. The preferred alternative includes enhancement of the existing refuge and a 38,200-acre expansion.

Water resource development actions in the basin have altered the natural flow patterns of some streams. Storage and diversion of streamflows reduce the natural flow during part of the year. In some cases, the stream is dewatered. Releases from storage also augment the natural flow during other times of the year, often during low flow periods. Planning for water projects should incorporate instream flow considerations as part of project operational criteria.

Riparian vegetation is critical for virtually all wildlife in the basin. Streambank stability and resistance to channel scouring are enhanced by healthy riparian communities. If those responsible for maintenance, improvement, and restoration would voluntarily restore and improve streambank vegetation whenever an opportunity occurs, the results could be significant.

RECREATIONAL ASPECTS OF WATER DEVELOPMENT

The purpose of Section 15 is to describe the Bear River Basin's leisure facilities and resources, identify problems and needs, and offer some recommendations. The section focuses on the water-related, outdoor recreational aspects of active and passive leisure activities. It also presents findings from the 1990 public meetings and telephone survey.

Access and immediacy to water is extremely important to the recreating public in Utah. Water-related activities usually rank in the top 12 outdoor recreation activities. Major water resources for recreation include Bear Lake, eight reservoirs, numerous small lakes and streams in the national forests, and vast marshes and wet areas along the shoreline of the Great Salt Lake.

Considerable acreage of land in the basin managed by state and federal agencies provide many opportunities for recreational use. Within Box Elder, Cache, and Rich counties

the Forest Service administers over 460,000 acres of land with over 2,860 visitor-days of capacity on 33 units. The Bureau of Land Management administers a large area, mostly in western Box Elder County. The U. S. Fish and Wildlife Service manages the 65,000 acre Bear River Migratory Bird Refuge in Box Elder County. The Utah Division of Wildlife Resources administers four major waterfowl areas in Box Elder County.

The Utah Division of Parks and Recreation administers about 3,840 acres of park land in the three basin counties. The division administers 44,600 surface acres of fresh water plus the surface of Great Salt Lake, pursuant to the state boating law. At Bear Lake, the division administers about 906 land acres at seven locations around the lake, plus about 34,250 surface acres on the Utah portion of the lake. Hyrum State Park has approximately 260 acres of land and 440 surface acres of water. Willard Bay State Park has about 2,673 acres of land, including 344 acres in two marinas, and 4,420 acres of water surface. Visitation dropped about 50 percent from 1986 to 1991 at Bear Lake and Willard Bay state parks due primarily to lowering water levels.

A major outdoor recreation household survey to determine what kind of outdoor recreation is occurring, public meetings to update critical outdoor recreation issues and needs, and a survey of recreation-providing government agencies to determine their respective expenditures for outdoor recreation were completed by the Division of Parks and Recreation in 1990. These provided part of the data needed to update the State Comprehensive Outdoor Recreation Plan (SCORP). The results are summarized for the Bear River Basin in Section 15.

Nearly \$5 million in grants from the Federal Land and Water Conservation Fund (LWCF) have been spent since 1965. Total value of projects with matching funds was nearly \$10 million. Most have been city

and county projects, and about 47 percent were in association with major water features. Bear Lake land acquisitions and development amounted to about \$1.8 million of the LWCF grants. To meet growing recreational needs, a balanced funding and operational cost program will have to be realized, utilizing federal, state, local, and private funds.

FEDERAL WATER PLANNING AND DEVELOPMENT

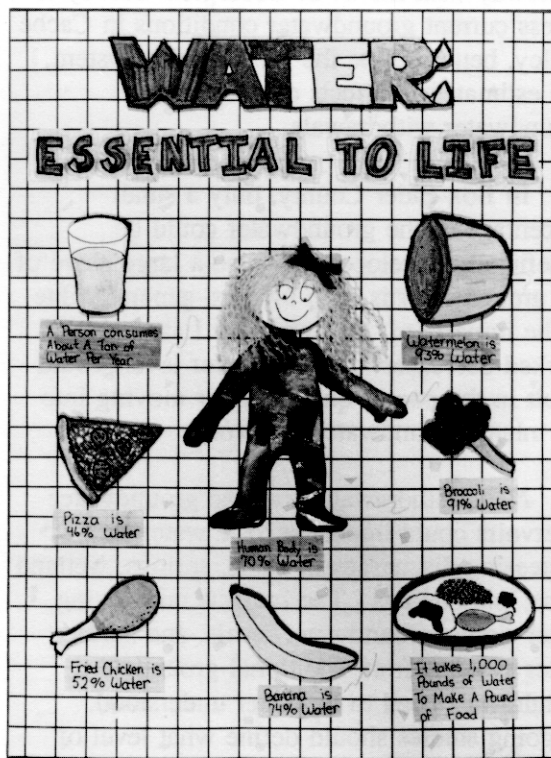
Section 16 describes past and expected future involvement of federal agencies in Bear River Basin water planning and development. Several federal agencies are actively involved in Bear River Basin planning, and several have been involved in planning and development for many years.

The Bureau of Reclamation and the Department of Agriculture have completed basinwide investigations. Hyrum Dam and Newton Dam were built by the Bureau of Reclamation many years ago. Irrigation improvements have been designed and built by the Soil Conservation Service in cooperation with other agencies and private local entities. The Department of Agriculture's water-related programs provide cost sharing and technical assistance. The Corps of Engineers recently conducted a flood reconnaissance study.

Federal programs most significant to the basin in the immediate future include the ongoing programs of the Department of Agriculture, the Environment Protection Agency's authority under the federal Safe Drinking Water Act and Clean Water Act, and the Fish and Wildlife Service's restoration and expansion plans for the Bear River Migratory Bird Refuge.

WATER CONSERVATION

Water conservation needs, issues, and alternatives are discussed in Section 17 along



KayCee Nielsen - 1991 Young Artists Water Education Poster Contest

with recommendations for conserving water. Two basic water conservation strategies are: (1) reduce demand by using supplies more efficiently, and (2) increase supplies by operating storage and delivery facilities more efficiently. The "wise use" of water requires involvement of both strategies.

The demand for more municipal and industrial water in the Bear River Basin is expected to increase by nearly 18,000 acre-feet by the year 2010. Agriculture use could increase by as much as 9,500 acre-feet if late season supplemental water is provided to existing irrigated cropland, and by another 18,000 acre-feet if water can be provided to non-irrigated cropland within the service area of existing irrigation systems. Additional water will be required for the expansion alternative of the Bear River Migratory Bird Refuge.

In terms of total foreseeable uses, it will be a long time before a limited water supply will necessitate a massive water conservation effort in the basin. Even though water supplies in the basin are generally plentiful, shortages already occur in some areas. Because of differing local circumstances, each area must be considered separately.

Water conservation methods and strategies available for use in the area include public information/education, institutionalizing water conservation, restricting water use, joint use of water supplies, landscaping and home water savings, pricing, reuse, and water measurement.

INDUSTRIAL WATER USE

Section 18 discusses industrial water use such as manufacturing of products, processing and washing operations, and commercial fish operations. Total industrial use in the basin is relatively small. Of the estimated 10,310 acre-feet of industrial use in the basin, about 80 percent is self-supplied; the remainder is from public supply systems. Almost all of the supply is from groundwater. Cache and Box Elder counties are attempting to attract new industries. Various estimates for additional industrial uses have been made, but they are not fully supported. One projection shows that if industrial water use grows at the same rate as the population in the next 20 years, it will increase from 10,310 acre-feet to 13,460 acre-feet. Updated information concerning future industrial water uses is needed.

GROUNDWATER

Groundwater conditions in the Bear River Basin, and important problems and issues, are described in Section 19. Groundwater is an important source of water for municipal, industrial, and agricultural uses. Of the 82,880 acre-feet of groundwater used in the basin in

1990, 60 percent was for municipal use, 27 percent for irrigation, and 13 percent for industrial use.

Groundwater reservoirs in the Bear River Basin are generally full. The recharge to groundwater in Cache County is estimated to be 170,000 acre-feet per year. The groundwater discharge is also estimated to be 170,000 acre-feet with 14 percent being pumped from wells, 49 percent discharging to streams and springs, and 37 percent owing to evapotranspiration. Box Elder County groundwater recharge is estimated to be 315,000 acre-feet per year. The discharge is estimated to be the same amount with one percent being pumped from wells, 67 percent discharging to streams, 32 percent going to evapotranspiration. Less than one percent leaves as subsurface outflow.

Cache County has a good supply of high quality groundwater for municipal use. A study made 20 years ago estimated an additional 75,000 acre-feet per year of groundwater could be withdrawn from Cache Valley aquifers without significantly impacting surface supplies. However, a study is currently

underway with the U. S. Geological Survey to access current groundwater conditions in Cache Valley, better define the groundwater system, and estimate the effects of additional groundwater withdrawals.

In Box Elder County, only a small percentage of the groundwater could be beneficially developed, because a large share of the groundwater is high in salts, generally due to the impacts of the Great Salt Lake. Any marked decreases in groundwater levels could result in the poorer quality water moving into the inland groundwater reservoirs.

New withdrawals from the groundwater reservoirs could impact surface water by decreasing discharges to wells, springs, wetland areas, and streams. The impacts on existing water rights, groundwater levels, and surface water systems from additional groundwater withdrawals need to be better understood. Ongoing studies should define what level of new development can occur without significant interference with existing water rights.